DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 13 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The preamble recites that the instant claim is a process claim, but no process steps are recited.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 2, 6-8, 11, and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Sekisui Chemical Co, Ltd., WO02/035555 published on 05/02/2002. The examiner notes for the record that Wakiya et al, US Patent No. 7252883, is a patent granted from the National Phase entry into the US of the corresponding PCT application (PCT/JP01/04543), and has been used herein as an equivalent English translation of WO02/35555.

3. Sekisui teaches a method for production of graft copolymers of polyolefins on modified metal-surfaced particles, wherein said metal-surfaced particles may be

particles made of metal, or may be obtained from the formation of a metal layer on a particle made of an organic or inorganic compound (Column 2, lines 42-47). This metal used is not particularly limited, with examples such as iron and aluminum (Column 2, lines 34-39) disclosed; the use of particles comprised of compounds such as indium tin oxide (ITO) is also taught. Metal-surfaced particles are first modified with an organic compound which contains both a polymerizing functional group and a functional group capable of binding to the metal surface of the particle (Column 3, line 54 to Column 4, line 4). Said polymerizing functional group can be unsaturated bond-containing groups such as vinyl and alkenyl groups (Column 4, line 11). A variety of metal-binding functional groups are taught, including such examples as carboxyl and silane functionalities (Column 2, lines 52-62). After modification of the metal-surface particles, graft polymerization can be performed using monomers, for example α-olefins such as ethylene and vinyl ester derivatives (Column 4 lines 63-66), which are compatible with said polymerizing functional group and, when necessary, a polymerization catalyst, which my contain transition metals such as ruthenium (Column 4, lines 36-38). Example 8 in Sekisui, for instance, teaches a method for covalently tethering 2-norbornene-6-methyldichlorosilane to gold-surfaced particles previously modified with mercaptoundecanol, followed by polymerization of norbornene using bis (tricyclohexylphosphine)benzylidene ruthenium (IV) dichloride as a polymerization catalyst.

Claim Rejections - 35 USC § 103

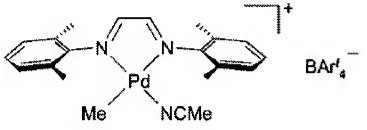
4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

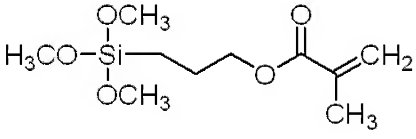
6. Claims 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sekisui Chemical Co, Ltd., WO02/035555, as applied to claim 1, 2, 6-8, 11, and 13 above, and further in view of Kiesewetter et al (Chem. Eur. J., 2003). Sekisui fails to teach the use of the specific polymerization catalysts described in the instant claims. Kiesewetter teaches the copolymerization of ethene and norbornene through the use of palladium (II) α-diimine catalysts, wherein the catalyst has the structure:



Kiesewetter discloses that high levels of norbornene incorporation into the resulting polymer chain are achieved when the polymerization reaction is performed using the catalyst pictured above. It would have been obvious to one skilled in the art that, once the norbornene structure was grafted onto the metal particle as taught by Sekisui, the catalyst taught by Kiesewetter could be used to catalyze a polymerization reaction via vinyl addition to the double bond of norbornene.

7. Claims 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sekisui Chemical Co, Ltd. as applied to claim 1, 2, 6-8, 11, and 13 above, and further in view of Johnson et al (J. Am. Chem. Soc., 1995). Johnson discloses the use of palladium (II)- or nickel (II)-based α-diimine catalysts having the same general structure as those disclosed in the instant application (see Johnson, Scheme 1) for the polymerization of ethylene and α-olefins. It would therefore have been obvious to one skilled in the art to modify the teachings of Sekisui Chemical Co, Ltd., which disclose the use of olefins such as ethylene (Column 4, line 63) as a monomer which may by polymerized on metal-surface particles, with those of Johnson as a method for catalyzing the desired polymerization.

8. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sekisui Chemical Co, Ltd. as applied to claims 1, 2, 6-8, 11, and 13 above, and further in view of Bourgeat-Lami et al (J. Colloid Inter. Sci., 1998). Sekisui does not explicitly recite the use of silica particles in the graft copolymerization process. Bourgeat-Lami teaches a method for grafting a polymer onto modified silica through a coupling agent. Silica particles are first modified through incubation with 3-(trimethoxysilyl) propyl methacrylate (Page 295, paragraph 2.2.2), which has the following structure:



Grafting of this coupling agent to the particle surface occurs through its trimethoxysilyl-functional group. Upon completion of this modification, polystyrene is then polymerized onto the silica particle through copolymerization with the coupling agent's carbon-carbon double bond. It would have been obvious to one of ordinary skill in the art that modification of silica particles with 3-(trimethoxysilyl) propyl methacrylate yields a modified metal particle analogous to those disclosed in Sekisui, and could therefore be subjected to the same polymerization reactions at the reactive carbon-carbon double bond.

9. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sekisui Chemical Co, Ltd., WO02/035555. As discussed earlier in this action, the cited reference teaches the formation of graft copolymers of olefins on modified metal-surface particles. The reference does not teach the incorporation of the resulting polymer-particle hybrid copolymer into a composition. The examiner notes that it is known in the art to incorporate particles into resins by mixing to produce a composition having improved properties. The examiner therefore takes the position that it would have been obvious to one of ordinary skill in the art that the polymer-particle graft copolymers taught by Sekisui Chemical Co. could be utilized as fillers in polyolefin resins.

10. Claims 1-8, 11, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pacific Corporation, JP 2003-73407 in view of Johnson. Kim et al, US Patent No. 7247378, is from the same patent family as JP 2003-73407 and is used herein as an equivalent English translation. Pacific Corp. teaches the production of graft copolymers on the surfaces of hydrophobic-treated inorganic particles. The examiner notes that metal compounds such as those disclosed by the applicant are inorganic compounds; the reference also discloses the use of titanium oxide and zinc oxide as examples of inorganic particles (Column 3, lines 31-32), which may be used in the invention. The reference also discloses that examples of organic compounds which may be utilized to treat the particle surface are reactive silane derivatives having a tetraethoxysilane group which can bind to the metal surface and an unsaturated double bond in its main chain or at an end, which can be used as a site for initiating olefin

polymerization (Column 3, lines 24-26. Pacific Corp. proceeds to disclose the polymerization of a variety of olefins through the use of a free radical initiator such as benzoyl peroxide (Column 3 line 54 to Column 4 line 16. Pacific Corp. does not teach the use of the catalysts described in the instant application.

11. As noted previously in this office action, Johnson teaches the use of transition metal catalysts for the polymerization of α-olefins. As noted above, Pacific Corp. discloses polymerization of olefin compounds on inorganic particles modified with organic compounds containing a double bond. The examiner takes the position that it would have been obvious to one of ordinary skill in the art that, once the inorganic particle was modified to have the reactive double bond, polymerization could be performed using the catalysts described by Johnson in lieu of the radical initiators disclosed in Pacific Corp.

12. Claims 1-11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hauser et al, US Patent No. 2401348, in view of Johnson.

13. Hauser teaches a method for the production of polymers grafted onto bentonite clay. Bentonite clay is first modified via incubation with a salt of a polymerizable olefinic carboxylic acid; specifically, lead acrylate. As disclosed by Hauser, incubation of bentonite clay with a solution containing said salt results in the substitution of the lead acrylate cation for the sodium ion of bentonite via base exchange, yielding a bentonite-lead acrylate compound in which the lead acrylate is held both on the surface and between the unit crystal sheets which constitute the bentonite particle (Column 3, lines

46-63). The substitution can be performed when the clay particles are dispersed in water (Column 4, lines 40-43). Hauser further teaches the use of pressure molding and heat molding to effect polymerization through the carbon-carbon double bond present in the immobilized acrylate functional group.

14. While Hauser teaches the use of heat molding to affect polymerization of the immobilized acrylate groups, thereby crosslinking the modified particles, it does not teach the use of a polymerization catalyst to form polymer chains. However, one of ordinary skill in the art would recognize that the modification of bentonite particles via substitution of lead acrylate results in the formation of a modified inorganic particle containing a double bond available as a polymerization site. As noted earlier in this office action, Johnson teaches that polymerization of α-olefins can be performed using catalysts comprising transition metals such as nickel and palladium complexed with α-diimine ligands. It would therefore have been obvious at the time of the invention that the bentonite-lead acrylate particles taught by Hauser could be subjected to polymerization via the use of the catalysts described by Johnson to arrive at the subject of the instant claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey Lenihan whose telephone number is (571)270-5452. The examiner can normally be reached on Mon-Thurs: 7:30-5:00, every other Friday 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, D. Lawrence Tarazano can be reached on 571-272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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